



NASA STTR 2011 Phase I Solicitation

T9.01 Technologies for Human and Robotic Space Exploration Propulsion Design and Manufacturing

Lead Center: MSFC

This subtopic solicits partnerships between academic institutions and small businesses in the following specific areas of interest: Innovative design and analysis techniques, manufacturing, materials, and processes relevant to propulsion systems launch vehicles, crew exploration vehicles, orbiters, and landers. Improvements are sought for increasing safety and reliability and reducing cost and weight of systems and components.

- Polymer Matrix Composites (PMCs) Large-scale manufacturing; innovative automated processes (e.g., fiber placement); advanced non-autoclave curing; damage-tolerant, repairable, and self-healing technologies; advanced materials and manufacturing processes for both cryogenic and high-temperature applications.
- Ceramic Matrix Composite (CMCs) and Ablatives CMC materials and processes are projected to significantly increase safety and reduce costs simultaneously while decreasing system weight for space transportation propulsion.
- Solid-state and friction stir welding, which target aluminum alloys, especially those applicable to high-performance aluminum-lithium alloys and aluminum metal-matrix composites, and high strength and high temperature or functionally graded materials.
- New advanced super alloys that resist hydrogen embrittlement and are compatible with high-pressure oxygen; innovative thermal-spray or cold-spray coating processes that substantially improve material properties, combine dissimilar materials, application of dense deposits of refractory metals and metal carbides, and coating on nonmetallic composite materials.
- Advanced NDE Methods Portable and lightweight NDE tools provide characterization of polymer, ceramic and metal-matrix composites, areas include, but are not limited to, microwaves, millimeter waves, infrared, laser ultrasonics, laser shearography, terahertz, and radiography.
- Improvement in techniques for predicting the self-generated dynamics of space propulsion system when operated at off-design conditions.
- Improvement in techniques for predicting the acoustic field produced by the operation of a space propulsion system in near ground operation.

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- Predictive capability of the performance and internal environment for systems, solid or liquid propellants, undergoing multi-phase combustion. Of special interest are systems utilizing nano-energetics solid fuels.
 - Predictive capability improvements for the coupled fluid-structural problem with focus on accurate prediction of heat-transfer that occurs in the chamber of a nuclear thermal rocket.
 - Design and analysis tools that accurately model small valves and turbopumps.
 - Development of databases and instrumentation advances required for validation of previously mentioned predictive capabilities.